ON AMPUTATION OF THE ENTIRE UPPER EXTREMITY IN THE CONTIGUITY OF THE TRUNK BY THE METHOD OF PAUL BERGER: WITH TWO CASES OF THE OPERATION.

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IT is rather surprising that no method of amputating the entire upper extremity, that is of the arm with the scapula and more or less of the clavicle should be described in our treatises on operative surgery. Though mainly to be explained by the comparative infrequency of the procedure, it is probably due in some measure to the want of any accepted or recognized mode of performing the operation, and may cease to be the case with the establishment of better known and regulated principles.

With this object, M. Paul Berger has recently published his treatise, a large one, on this one amputation (*L'Amputation du membre superiéur dans la contiguitè du tronc.* Paris: 1887.)

The work is based on a full critical revision of all the literature and reported cases, on numerous experimental observations on the dead subject, and on the experience of a case of his own. The method he advocates is a decided advance on what has hitherto been done, combining the greatest security against accident with a well arranged order of procedure. The operation is performed in two stages, the first of which includes the treatment of the large vessels, the second fashioning the flaps and removing the limb.

I adopted it in the two following cases which were under my care in the Queen's hospital within a few months of each other, and which I think are the first of the kind.

The description of the operation is, as nearly as possible, Berger's own:

CASE I.—F. S., female, æt. 21; was brought to me by Mr. Cooke, of the Parade, in May, 1887, on account of a large growth of the upper end of the humerus. The tumor, which was of firm consistence and as large as a cocoa-nut, lay under the deltoid and englobed the articulation, though leaving its movements fairly free.

There was another large secondary tumor in the axilla, quite movable over the wall of the thorax.

The disease was of nearly two years' duration, and the general health but little injured.

I was anxious to amputate at once, but the parents would not hear of it, and a further month elapsed before the terrible increase of suffering induced them to welcome anything which offered a prospect of relief. Unfortunately by this time another nodule had appeared in the fossa above the clavicle. It was, however, isolated and movable, and appeared to represent the limits of the disease.

Operation.—First Stage: Resection of middle third of clavicle.— The arm being brought down to the side, an incision commencing one inch outside the sterno-clavicular joint was carried along the clavicle to its external end. The periosteum was then raised by elevator from that part of the bone between the attachments of the rhomboid and coraco-clavicular ligaments, and the denuded portion removed by the saw.

Second stage—Securing the vessels.—The previous step exposes the subclavius muscle in a fibrous sheath. These are to be cut across and the upper border of the pectoralis minor defined, while the cephalic vein and any branches of the acromio-thoracic artery which interfere may be ligatured and cut. In searching for the artery (subclavian) I found a guide recommended by Berger, viz., the external anterior thoracic nerve, serviceable. This nerve is so prominent that it can hardly escape observation, and if followed upward, it leads to the interval between the artery and vein.

The artery having been cleared for a sufficient distance, I applied two silk ligatures, rather more than half an inch apart, and severed the vessel between them. The vein was then served in a similar manner. This required to be done with more care and delicacy than in the case of the artery. Before tightening the ligatures on the vein the limb was held vertically for two minutes to empty it of blood.

The supra-scapular vessels which cross the upper part of the wound were next cut between two ligatures.

It will be seen that the operator is now secure against hæmorrhage from both the proximal and distal ends of the artery and the vein, and that there is no chance of air entering the latter. The only remaining vessel of importance is the posterior scapular, which is not cut till the end of the operation.

Third Stage. Cutting the Flaps and Removing the Limb.—Two flaps are to be made.

1. An antero-inferior flap.—From the middle of the first or clavicular incision another was carried down the front of the shoulder, and across the inner side of the arm in a backward direction to the tip of the angle of the scapula where it terminated.

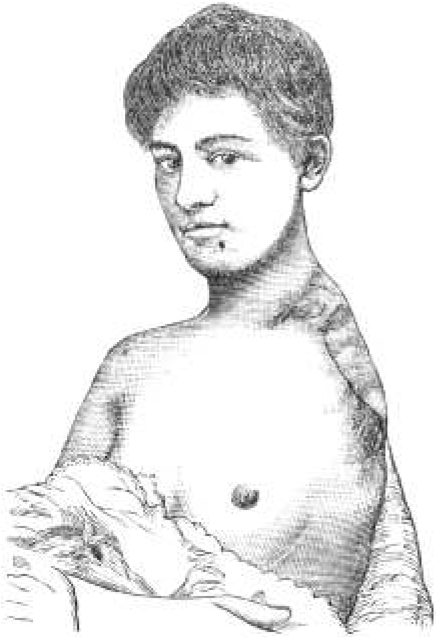

FIG. 1.—RESULT AFTER AMPUTATION OF ENTIRE UPPER EXTREMITY.

The integuments were lifted up for a little way and the pectoralis major and minor cut across, The large cords of the brachial plexus were next severed, and the arm with the axillary tumor was drawn away from the side as in the dissecting room. The latissimus and teres major forming the posterior fold of the axilla were also divided.

2. A postero-superior flap.—The patient being rolled on to the sound side and the limb drawn across the chest, an incision was carried from the outer end of the first or clavicular. one straight down the back of the shoulder to the angle of the scapula where it joined the preceding.

The integuments were dissected up as far as the vertebral border of the scapula and the limb severed from the body by sweeping the knife along its upper and posterior borders close to the bone so as to divide successively all the muscles there attached.

Before closing the wound I had next to give my attention to the removal of the supraclavicular glands, a proceeding which I found rather tedious and difficult.

The immediate result of the operation was most satisfactory, the flaps fitted admirably, without tension or redundancy, and the total wound surface was of very moderate dimensions. The wound was quite healed and the patient up in three weeks. Very little blood was lost from the circulation, and scarcely any depression of vital power followed the operation. (See Fig. 1.)

Tumor.—This was an ossifying periosteal sarcoma (mixed celled). The secondary gland tumors were also in process of ossification.

Subsequent history—Symptoms of recurrence of the disease in the cervical glands appeared at an early date, and a tumor, which ultimately attained enormous dimensions, formed there, of which she died within the year.

No post-mortem could be made.

CASE II.—G. D., 17, a male, was brought to me in March, 1888, by Mr. West, of Coventry, for a large sarcomatous tumor of the upper end of the right humerus. He had noticed it six months before, but the rate of growth had recently become very rapid. The shoulder was obscured and the axilla filled by an ovoid swelling of firm consistence. The scapula was overlapped, but not implicated, and the movements of the joint were fairly free. The skin was tight but not implicated, and no enlarged glands were to be felt in the neck or axilla.

While it was obvious that no form of shoulder-joint amputation could suffice, the case appeared admirably suited for the operation just described. I proposed it, but the patient declined, and returned home for five weeks. When at last he consented, the tumor was much larger, but I was able by shortening and modifying the outline of the flaps to give a wide margin of healthy tissue.

The operation was so identical with the preceding that I need not describe it in detail. I may note, however, that the method permits of very considerable modification of the outlines of the flaps to meet the requirements of individual cases. The hæmorrhage, too, was more free than in the other case, but apparently from the tumor rather than the general circulation.

The lad suffered wonderfully little shock, and the wound rapidly healed, so that he returned home with it sound in a month.

Up to the present time he has remained free from any sign of recurrence. The tumor was found to be a soft (round celled) periosteal sarcoma, showing small patches of caseation.

From my experience of these cases I believe the method offers a very sure and efficacious means of performing the operation. At the same time I think it will be found to suit cases of disease better than those of injury. In the latter we have so commonly to cut the coat to the cloth, and the condition of the patient frequently renders any elaboration of our proceedings undesirable.

From all sources Berger has collected together 50 cases of the operation done by all methods, which may be grouped into three orders:

1. Traumatic cases—13, with 8 recoveries and 5 deaths; a mortality of 1 in $2^1/_2$.

2. Total pathological—21; 17 recoveries, 4 deaths; mortality 1 in 5.

3. Consecutive or secondary pathological, *i. e.*, of the shoulder bones, for recurrence of disease after previous amputation at or below the shoulder joint—16; 13 recoveries, 3 deaths; mortality, 1 in $4^1/_2$.

This shows, as we should expect, a considerably higher mortality for traumatic than pathological cases, due to the initial shock and loss of blood, but somewhat contrary to what we might expect (as in the hip) gives no advantage to the secondary over the total amputations.

CAUSES OF DEATH.

These range as under:

Hemorrhage, entrance of air into veins.

Shock of operation, of injury.

Purulent infection, secondary hæmorrhage, exhaustion and sloughing.

Undoubtedly, hæmorrhage is the most formidable of the difficulties, occurring not only from the main trunks, but from the numerous large anastomosing branches round the shoulder; also the large veins over the tumor may be a source of embarrassment and danger.

Three of the deaths are due to uncontrollable hæmorrhage, but it doubtless contributed in some of the other cases.

Entrance of air into veins is to be feared as we approach the confines of the dangerous region. It occurred in 4 of the cases, and is credited with 2 deaths.

Shock has been most fatal in the cases of injury. In the production of this, the primary shock has largely contributed, the patients being in a state of great vital depression at the time of operation. Pure operative shock, as in the pathological cases, is not a marked feature. In my own cases it hardly existed. The operation is in this respect much more favorable than that at the hip.

Of the consecutive complications—wound diseases—we shall hear less under present conditions of wound treatment, though sloughing of flaps may always occur where the the tissues have been devitalized by injury.

Indications for operation. These have been as follows:

I. Tumors of scapula necessitating removal of the greater portion of that bone.

II. Tumors of upper end of humerus:

1. Benign, if of such excessive size as to render amputation at the shoulder impracticable.

2. Malignant; developed so far as to englobe the articulation: to invade the scapula or the muscles passing from it, the skin over the deltoid, and above all the lymphatic glands in the axilla.

III. Traumatic cases. These are commonly operations of necessity, including such injuries as gun and cannon shot wounds with extensive shredding and laceration of integuments round the shoulder; machinery accidents, causing extensive lacerations and comminution of bones and tearing away of the entire limb.

PRINCIPAL FEATURES OF VARIOUS OPERATIVE METHODS.

First for control of hemorrhage:

1. Compression, digital or instrumental, above the clavicle, the vessels being tied on the face of the flaps in the ordinary way.
2. Direct compression after excising the middle third of the clavicle.
3. Ligature of the subclavian artery by separate (supraclavicular) incision.
4. Ligature of ditto after resection of middle third of clavicle.
5. Ligature of both artery and vein by separate (supraclavicular) incision.

It will be seen that none of these methods fulfil all possible and requisite conditions of safety so thoroughly as Berger's.

Second, as to the order of division of parts.

In a considerable number of the cases the surgeon has first removed the arm at the shoulder, and then having secured the large vessels, proceeded to the removal of the other bones by separate incisions along the clavicle and spine of scapula. Generally, however, they have all been removed together, and when this is the case there is no doubt the scapula should come last in the order of procedure.